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DATA SHEET

BFQ135
NPN 6.5 GHz wideband transistor

Product specification
Supersedes data of September 1995
File under Discrete Semiconductors, SC14

1997 Nov 07

Philips
Semiconductors

PHILIPS

NPN 6.5 GHz wideband transistor BFQ135

FEATURES

- Optimum temperature profile and excellent reliability properties ensured by emitter-ballasting resistors and application of gold sandwich metallization.

APPLICATIONS

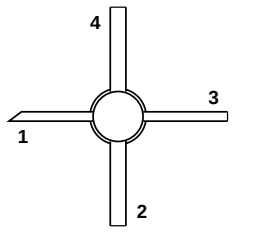
- MATV and microwave amplifiers, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers, etc.

DESCRIPTION

NPN wideband transistor in a 4-lead dual-emitter SOT172A2 package with a ceramic cap. All leads are isolated from the mounting base.

PINNING

PIN	DESCRIPTION
1	collector
2, 4	emitter
3	base



Top view MSA457

Fig.1 SOT172A2.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	19	V
I_C	collector current (DC)		–	–	150	mA
P_{tot}	total power dissipation	$T_c \leq 145$ °C	–	–	2.7	W
h_{FE}	DC current gain	I_C = 120 mA; V_{CE} = 18 V; T_{amb} = 25 °C	55	–	–	
f_T	transition frequency	I_C = 120 mA; V_{CE} = 18 V; f = 1 GHz; T_{amb} = 25 °C	–	6.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 120 mA ; V_{CE} = 18 V; f = 500 MHz; T_{amb} = 25 °C	–	17	–	dB
		I_C = 120 mA; V_{CE} = 18 V; f = 800 MHz; T_{amb} = 25 °C	–	13.5	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 120 mA; V_{CE} = 18 V; R_L = 75 Ω; $f_p + f_q - f_r$ = 793.25 MHz; T_{amb} = 25 °C	–	1.2	–	V

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	19	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	collector current (DC)		–	150	mA
P_{tot}	total power dissipation	$T_c \leq 145$ °C	–	2.7	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	20	K/W

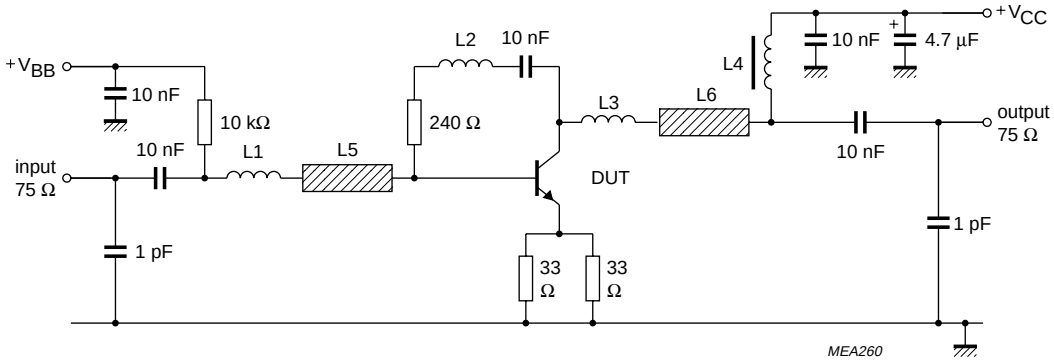
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 18 V	–	–	50	µA
h_{FE}	DC current gain	I_C = 120 mA; V_{CE} = 18 V; T_{amb} = 25 °C	55	–	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 18 V; f = 1 MHz	–	1.8	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	5.5	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 18 V; f = 1 MHz	–	1	1.2	pF
f_T	transition frequency	I_C = 120 mA; V_{CE} = 18 V; f = 1 GHz; T_{amb} = 25 °C	–	6.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 120 mA; V_{CE} = 18 V; f = 500 MHz; T_{amb} = 25 °C	–	17	–	dB
		I_C = 120 mA; V_{CE} = 18 V; f = 800 MHz; T_{amb} = 25 °C	–	13.5	–	dB
V_O	output voltage	note 2	–	1.35	–	V
		note 3	–	1.2	–	V
d_2	second order intermodulation distortion	note 4	–	–70	–	dB
		note 5	–	–70	–	dB

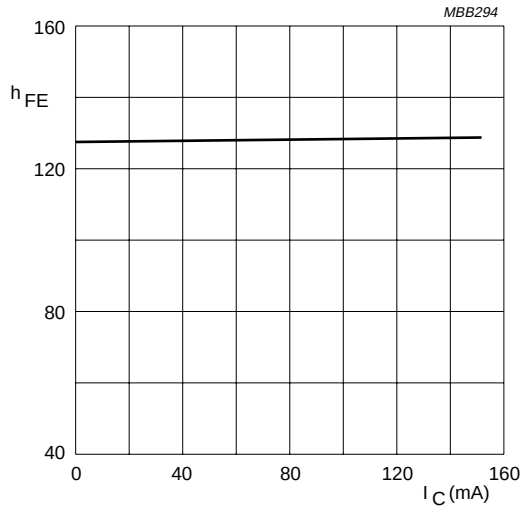
Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{\left(1-|S_{11}|^2\right)\left(1-|S_{22}|^2\right)}$ dB.
2. d_{im} = –60 dB (DIN 45004B); I_C = 120 mA; V_{CE} = 18 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 445.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 453.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 455.25 MHz;
   measured at $f_p + f_q - f_r$ = 443.25 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 120 mA; V_{CE} = 18 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_p + f_q - f_r$ = 793.25 MHz.
4. I_C = 90 mA; V_{CE} = 18 V; V_O = 50 dBmV; T_{amb} = 25 °C;
   f_p = 50 MHz; f_q = 400 MHz;
   measured at $f_p + f_q$ = 450 MHz.
5. I_C = 90 mA; V_{CE} = 18 V; V_O = 50 dBmV; T_{amb} = 25 °C;
   f_p = 250 MHz; f_q = 560 MHz;
   measured at $f_p + f_q$ = 810 MHz.



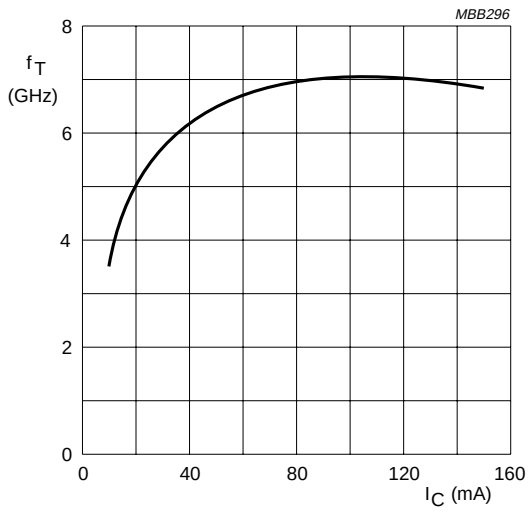
L1 = 8 nH.
L2 = 15 nH (2 turns copper wire, internal diameter 2 mm).
L3 = 10 nH (2 turns copper wire, internal diameter 1.5 mm).
L5: Lp = 21 mm; Rc = 75 Ω.
L6: Lp = 16 mm; Rc = 75 Ω.

Fig.2 Intermodulation distortion test circuit.



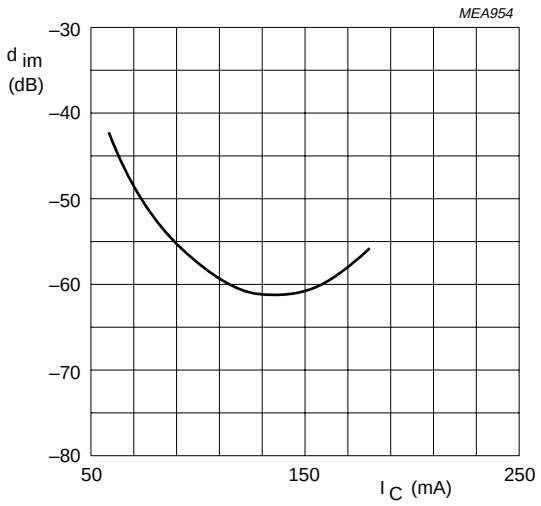
V_{CE} = 18 V; T_{amb} = 25 °C.

Fig.3 DC current gain as a function of collector current; typical values.



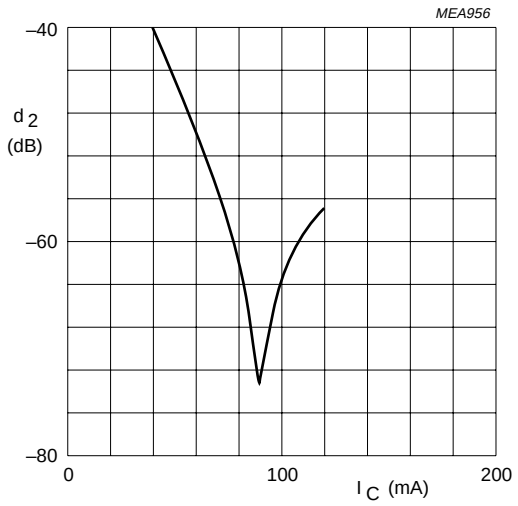
V_{CE} = 18 V; f = 1 GHz; T_{amb} = 25 °C.

Fig.4 Transition frequency as a function of collector current; typical values.



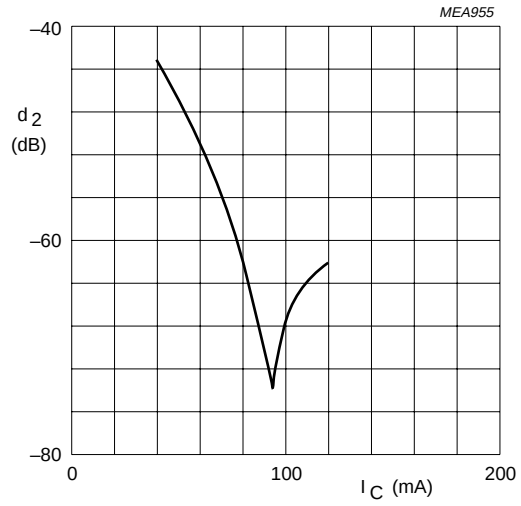
V_{CE} = 18 V.

Fig.5 Intermodulation distortion as a function of collector current; typical values.



V_{CE} = 18 V; V_O = 50 dBmV; T_{amb} = 25 °C; measured at $f_p + f_q$ = 450 MHz.

Fig.6 Second order intermodulation distortion as a function of collector current; typical values.

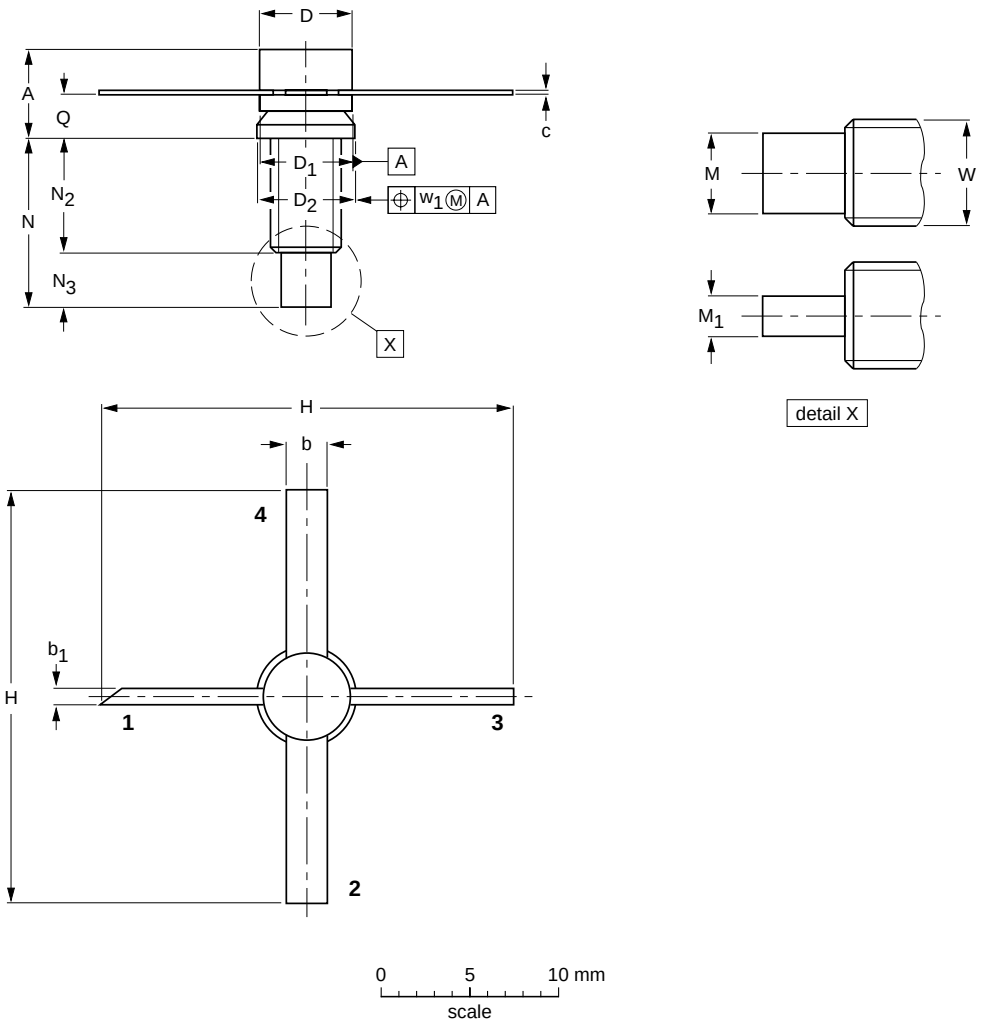


V_{CE} = 18 V; V_O = 50 dBmV; T_{amb} = 25 °C; measured at $f_p + f_q$ = 810 MHz.

Fig.7 Second order intermodulation distortion as a function of collector current; typical values.

PACKAGE OUTLINE

Studded ceramic package; 4 leads **SOT172A2**



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	b_1	c	D	D_1	D_2	H	M	M_1	N	N_2	N_3	Q	W	w_1
mm	5.51 4.45	1.66 1.39	0.89 0.63	0.16 0.10	5.20 4.95	5.33 5.08	5.33 5.08	23.37 22.35	3.05 2.79	1.66 1.39	11.56 11.04	8.38 7.62	3.69 2.92	2.95 2.43	8-32 UNC	0.38
inches	0.217 0.175	0.065 0.055	0.035 0.025	0.006 0.004	0.205 0.195	0.210 0.200	0.210 0.200	0.92 0.88	0.12 0.11	0.065 0.055	0.465 0.435	0.33 0.30	0.145 0.115	0.116 0.096		0.015

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT172A2						97-06-28

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Short-form specification	The data in this specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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